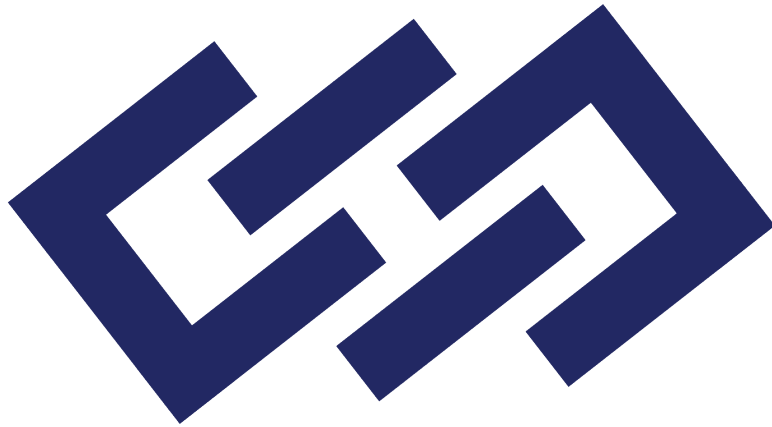


# WORKFLOW OF EXPORTING REVIT MODELS TO UNITY



PENN STATE

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COMPUTER INTEGRATED  
CONSTRUCTION

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## NOTE:

This document is developed by Penn State CIC. The workflow is tested on Revit 2016 and 2017 and 3ds max 2016 and 2017. The workflow documented will also work for older versions, although results might vary slightly.

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## EXPORT MODEL FROM REVIT

1. Load the Revit model. Instead of double clicking from the file, open the model from Revit by clicking “Open...” (Open project). This method allows the user to detach the model from the central file. In the open project dialog, uncheck the box “Detach from Central” if central file is accessed. Click Open, then select “Detach and discard work sets” in the popup window. (See Figure 1)

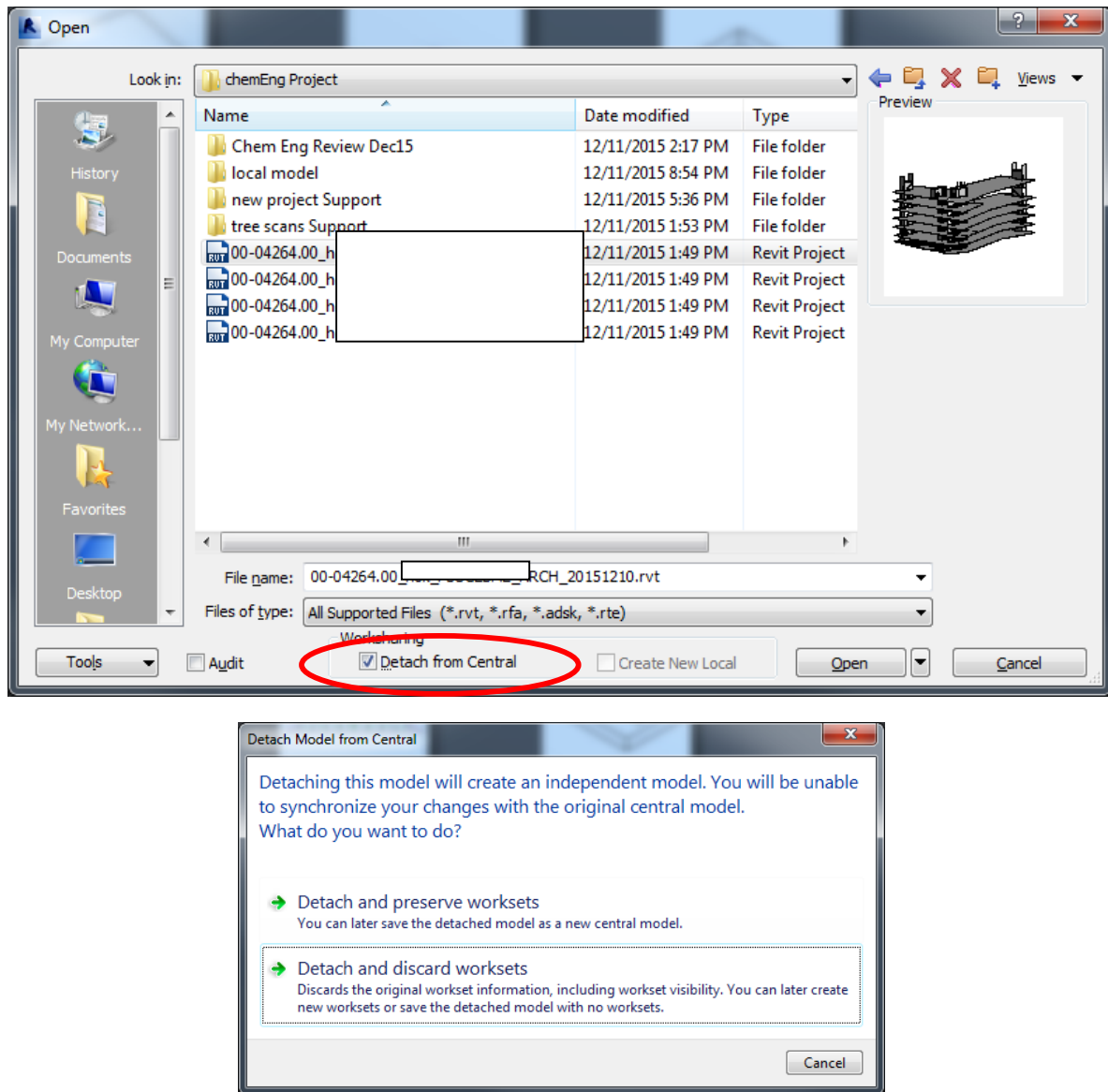
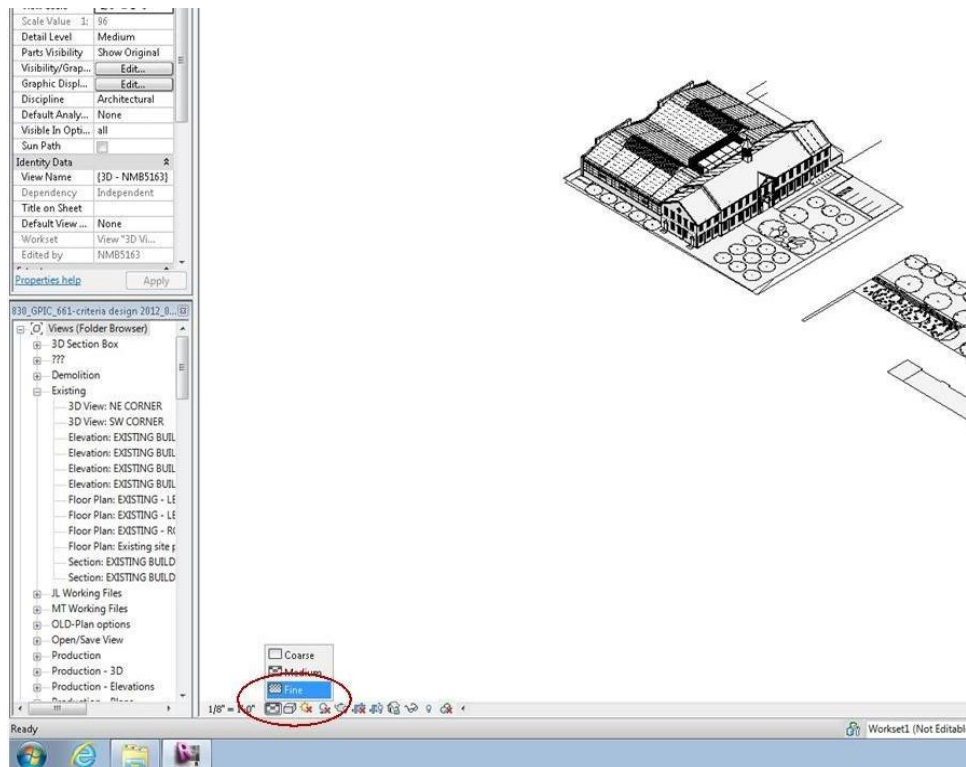


FIGURE 1 : SUMMARY ON HOW TO OPEN THE REVIT FILE



2. Go to 3D view by clicking the 'House' button at the quick access bar at the top. Set the Level of Detail to Fine and Visual Style to Realistic. (See Figure 2)



**FIGURE 2: SUMMARY ON HOW TO CHANGE THE DETAIL AND VISUAL STYLE OF A PROJECT**

Note: Objects hidden in view will not be exported. Thus, the user needs to make sure that the desired objects are visible and undesired objects hidden.



To check the objects' visibility in the project, following steps can be done.

- a. Check the phasing and make sure the phase filter is set to "Show Complete" and the phase is set to "New Construction". (See Figure 3)

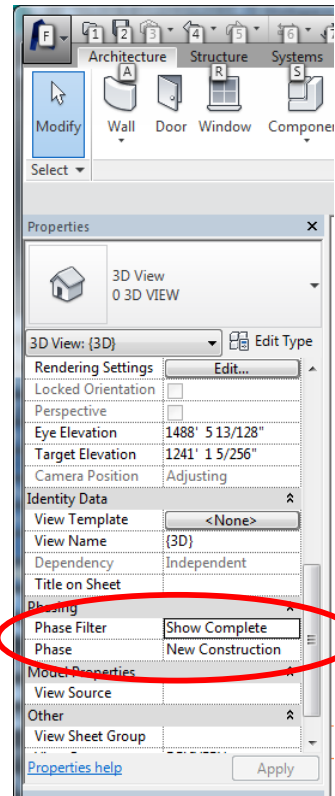


FIGURE 3: HOW TO CHECK OBJECTS' VISIBILITY

- b. Click the 'Light Bulb' to view all the invisible elements. (See Figure 4)



FIGURE 4: LOCATION OF 'LIGHT BULB' TO VIEW WHICH OBJECTS ARE HIDDEN

- c. Press "VV" or "VG" to bring up the Visibility and Graphic dialog. This window allows the user to show or hide Revit elements by model category.

To hide any element, Select the desired element → right click and select 'Hide in View'

3. Remember the name of the Revit 3D view ({3D} by default) and save the Revit File.

Note: The name of the 3D View is important when importing the model to 3DS Max



## IMPORT YOUR MODEL INTO 3D STUDIO MAX (3DS MAX)

1. Open 3D Studio Max.
2. Click on the “M” (3D Studio Max 2013 or later) icon in the top left-hand corner of the screen, click Import.

Note: click import from the first level of menu (See Figure 5). On 3ds max 2016, linking/Importing FBX model might result in wrong scale and increase in polygon count. However, the benefit of linking/importing FBX is that it will preserve the model elements, whereas in some rare occasions, direct import may lose some model elements.

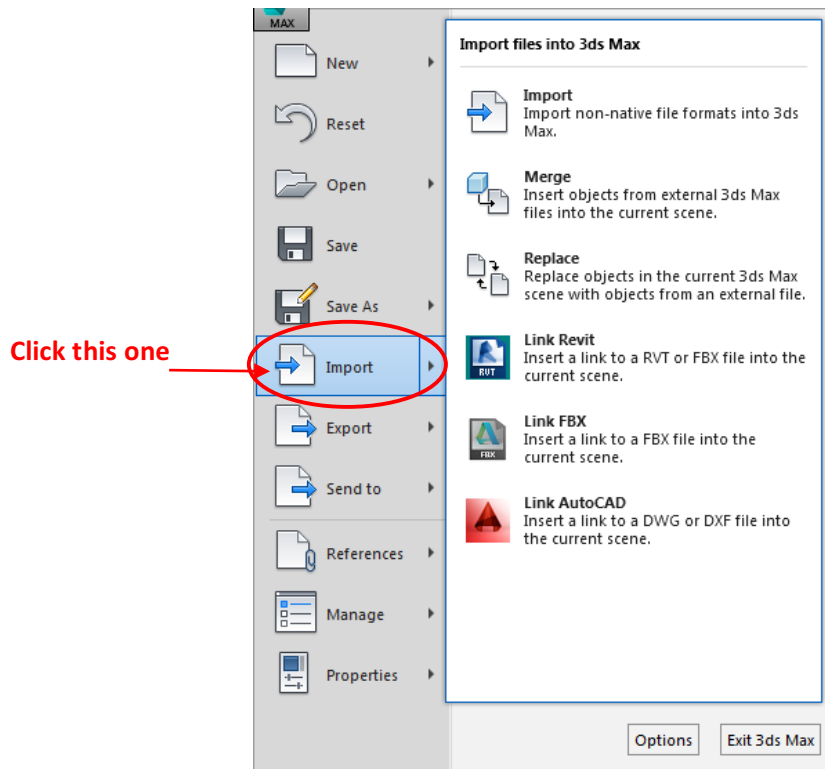


FIGURE5: IMPORTING REVIT MODEL INTO 3DS MAX



3. In order to import most polygon efficient model, set the Import setting as shown in Figure 6 below. The Revit view selected should be {3D} (default view from Revit) or, if not, name of other 3D view in the Revit model. Combine Entity should be set to “Do Not Combine Entities” for maximum control and to leverage Unity’s occlusion culling later on. In rare cases, if your model does not use any occlusion culling or does not require any control over individual elements, you may choose to “Combine by Material”, which improves rendering speed in Unity.

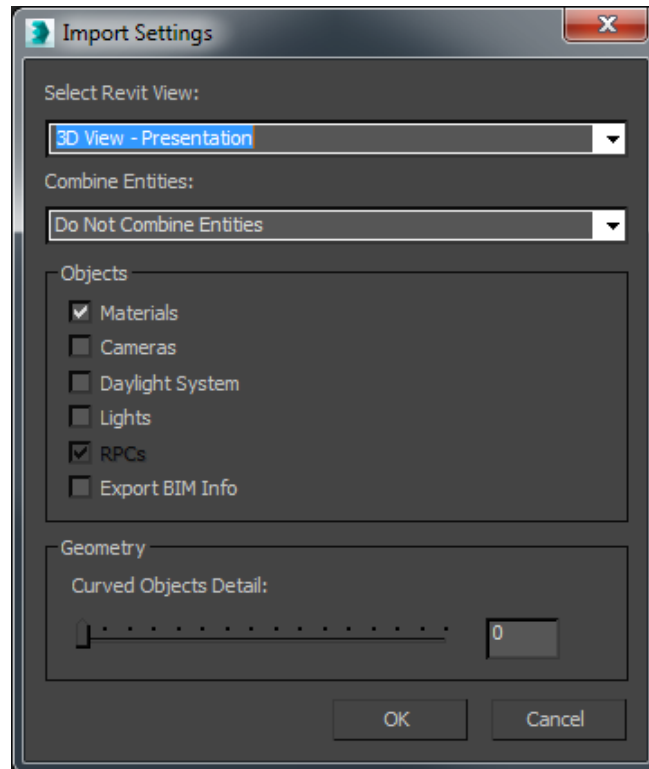
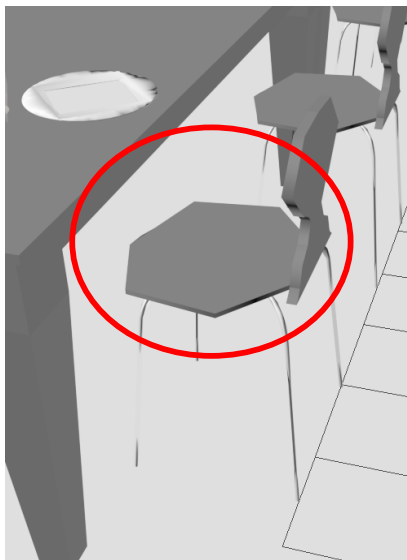


FIGURE 6: IMPORT SETTINGS

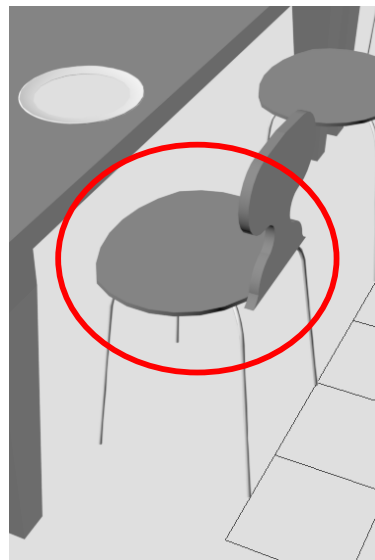


**Note:** 'Curved Object Detail' determines the detail of your model. To reduce polygon count of the model, it is recommended to start by setting the detail '0'. This, however, may have undesirable side effect on curvy and round objects as low 'Curved Object Detail' will make the imported object to look jagged or sometimes it will also transform those objects into other shapes. After importing the model, the user should check the key curvy objects in the scene (round columns, key furniture, arch structures, etc.) to make sure the quality and detail of those objects meet expectation. If not, the user needs to re-import the model with increased "Curved Objects Detail". Figure 7 and Figure 8 shows the comparison between low 'Curved Object Details' and default 'Curved Object Details'.



**FIGURE 7: OBJECT WITH CURVED OBJECT  
DETAIL: 0**

Benefit: Lower polygon count



**FIGURE 8: OBJECT WITH CURVED OBJECT  
DETAIL: 8**

Benefit: Smoother but high poly count





4. After the model is imported, do a quick walk through of the model to ensure that all the objects are successfully imported into 3DS Max (Our experience shows stairs may not be correctly imported). If there are missing objects, the user needs to go back to Revit and do these steps:
  - a. Hide all the objects in Revit **EXCEPT** the missing objects.
  - b. Exports the missing object as FBX file. (Figure 10)

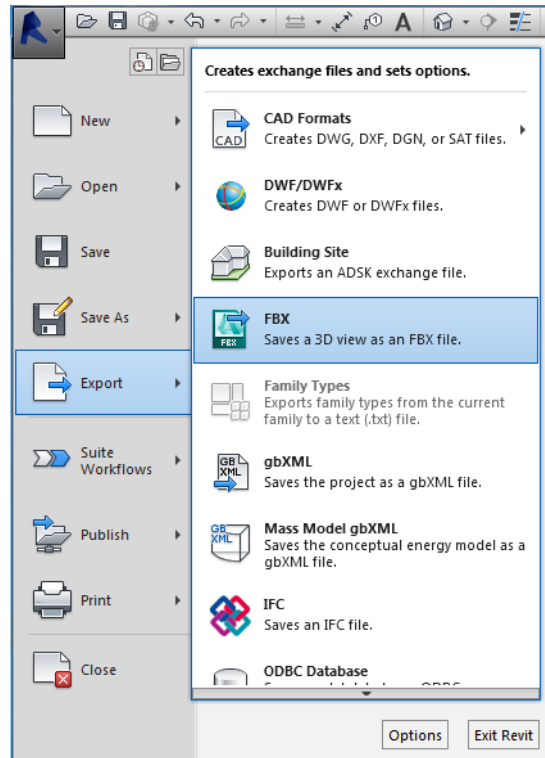


FIGURE 10: EXPORTING 'MISSING OBJECTS' AS FBX FILES



- c. Go back to 3ds Max. There are 2 alternatives on how the missing object can be imported:
  - i) Click the 'M' Icon→References→Manage Link. Search the FBX file and set the Preset to 'Autodesk Revit- Do Not Combine Entities' →Attach File → go to files tab → bind (Figure 11)

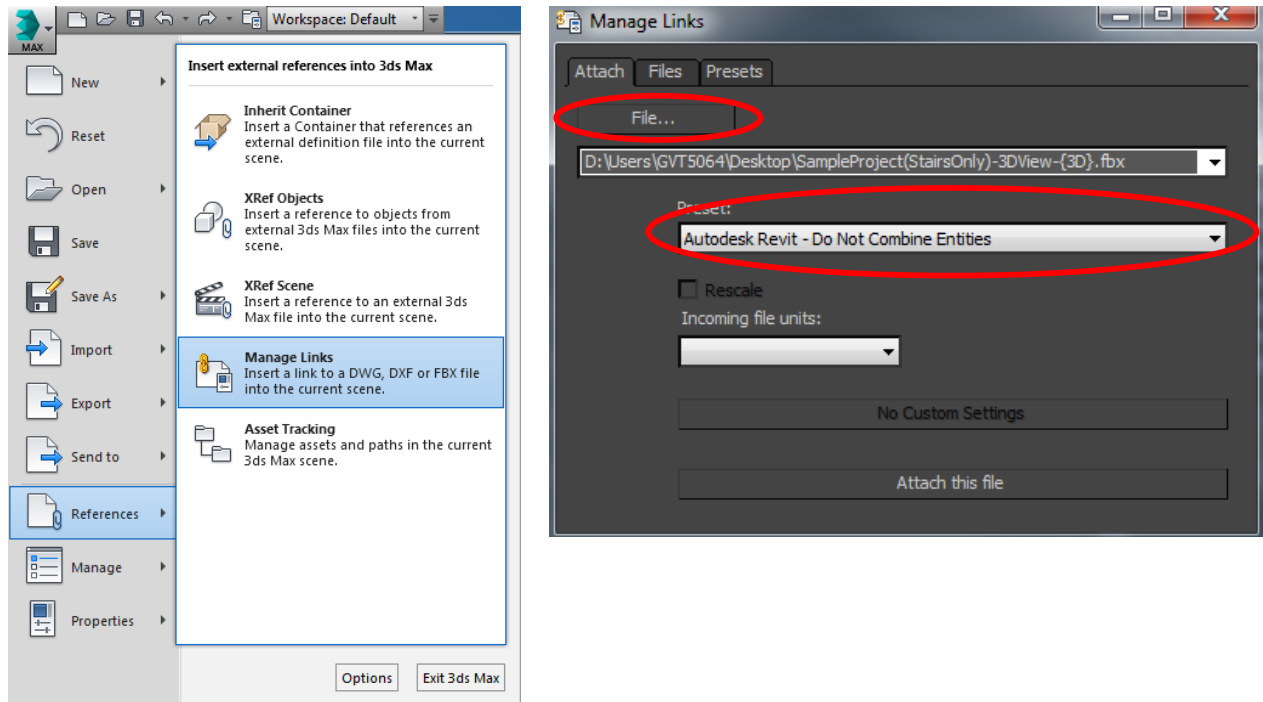
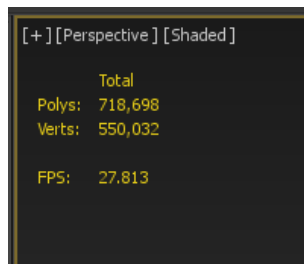


FIGURE 11: SUMMARY ON HOW TO IMPORT THE MISSING FBX FILE INTO 3DS MAX

- ii) Click the 'M' Icon→Import→Find FBX Files (Similar to Step 2)
5. When the model is fully imported, press 7 to view the polygon count of the model.



If your model polygon count is larger than 10 million. Polygon reduction should be performed (See Step 4 at 'Model Optimization in 3DS Max' for detail). Generally, step 4 is recommended unless the model is very simple.



## MODEL OPTIMIZATION IN 3DS MAX

1. The textures in Revit model does not usually show up in 3DS Max viewport by default. This is because the material from Revit is a special type of material that differs from materials commonly used in 3DS Max. Virtual reality software usually only read the standard material of 3DS Max, which is why Revit materials do not come across into the virtual reality software. To convert the Revit material to 3ds max standard material, maxscript called “Autodesk Material Convert” (AMC) need to be used (<http://www.3dstudio.nl/webshop/category/14-3dstudio>). Unfortunately, the software is not free to use. AMC is very easy to use and a quick demo of the workflow can be found here: <http://vimeo.com/49507833>
2. There is a manual way of applying textures in Unity. This will be discussed in Appendix A of this manual.
3. [Optional] To access material list in 3DS Max, press ‘m’ on the keyboard. In the slate material editor, click material → get all scene materials. Tree of material boxes will be viewable in the view tab (Figure 12). Find the bitmap nodes, and you can see if they have textures loaded in the bitmap.

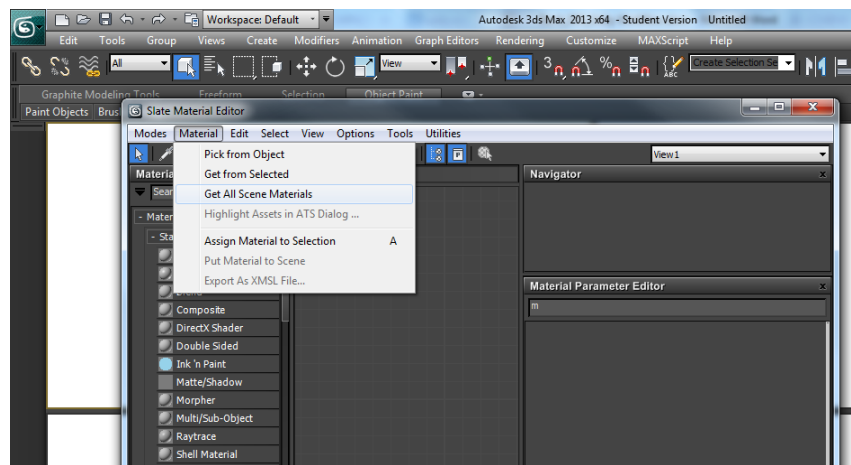


FIGURE 12: QUICK GUIDELINES ON HOW TO SEE ALL MATERIALS IN THE MODEL



#### 4. Model Optimization:

- a) Change the rendering option from 'Shaded' to 'Edged Faces' to show the polygon edges in the viewport so that complex objects can be easily identified. (See Figure 13) Then, configure the Viewport by: Right clicking on any of these buttons located in the



bottom right corner to bring up 'Viewport Configuration' (See Figure 14). Click on 'Statistics' Tab and change the Setup from 'Total' to 'Total + Selection'. Hit 'Ok'. This will allow the user to compare the number of total polygon count of the whole model and the polygon count of the object selected.

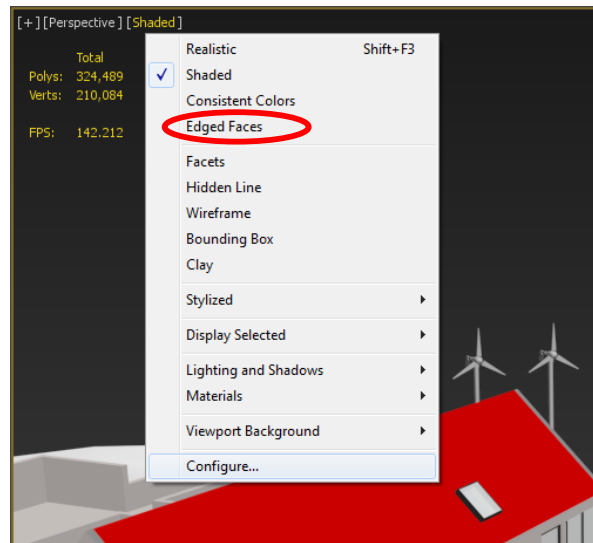
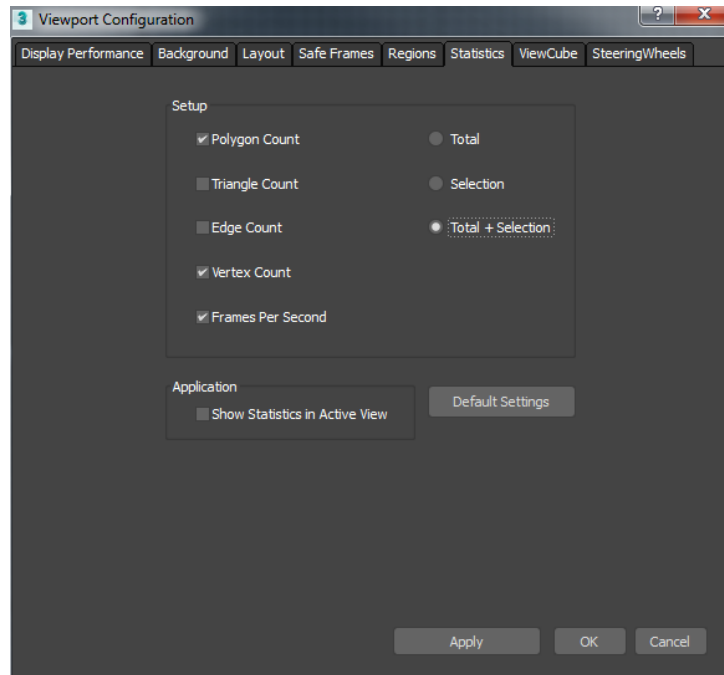


FIGURE 13: SHOW EDGE FACE RENDER MODE





**FIGURE 14: HOW TO SET-UP VIEWPORT CONFIGURATION**

b) There are 2 ways to reduce the polygon count of the model.

- i. Reducing polygon by using “Prooptimizer” and “MultiRes” modifier. To apply modifier to an object: select the object → Click on Modifier Tab (See Figure 15) → click the drop down list → search for “Pro-optimizer” or “MultiRes” → Calculate the initial number of Vertex by clicking on ‘Calculate’ → Reduce the ‘Vertex %’ to desired level and press ‘Enter. The polygon number of the selected object should be significantly reduced (See Figure 16).

Note: Before proceeding to the next step, it is advisable to walk through your building and check whether the object of the reduced polygon meets the project requirements (i.e: is there any undesirable shape changes, especially for the round and circular objects?)

- ii. Convert the model into editable poly by: Group entire building Model → select the model → right click → convert to editable poly → ungroup the model.

Note: This step results in moderate reduction and may damage the shape of curvy and round objects. Hence, it is recommended to reduce the polygon count using “Prooptimizer” or “MultiRes” compared to “Convert to editable Poly”.



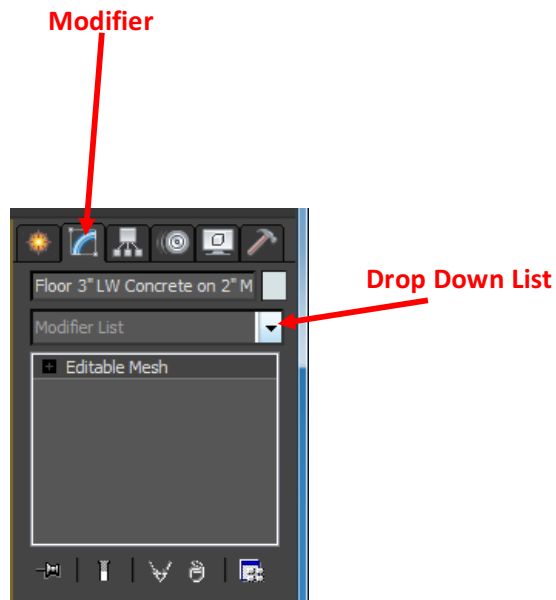


FIGURE 15: MODIFIER TAB

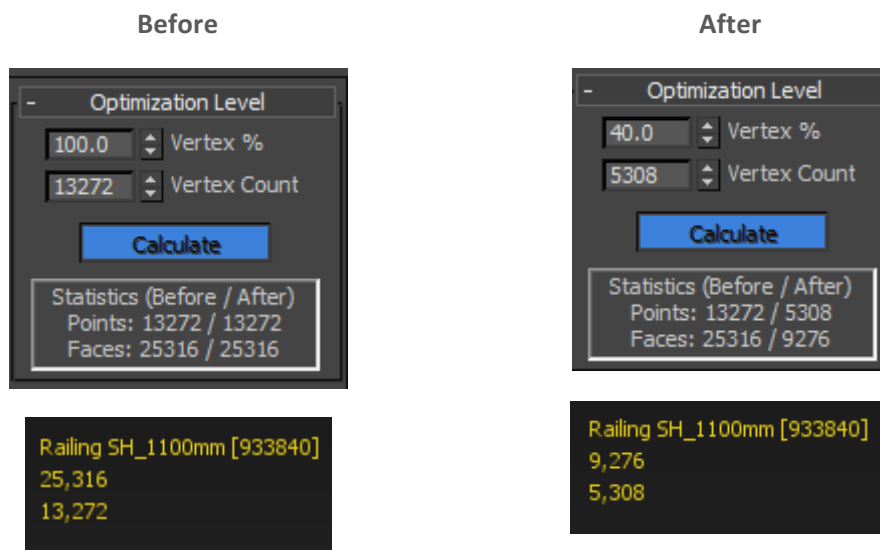
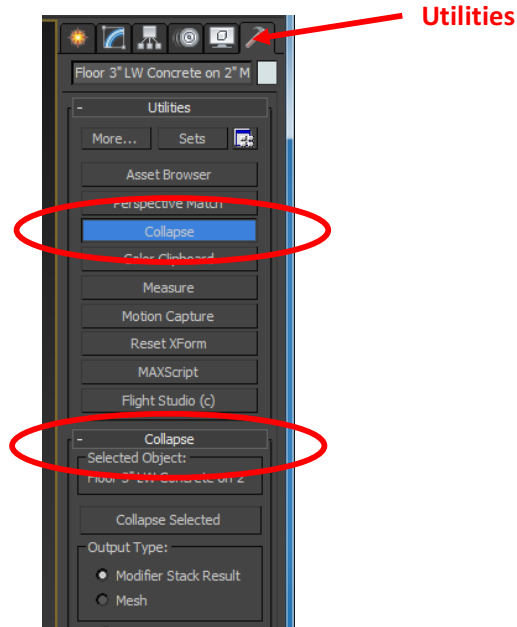


FIGURE 16: COMPARISON BETWEEN 'BEFORE' AND 'AFTER MODEL OPTIMIZATION



- iii. After setting up the modifier, the last step is to collapse the modifier into the Mesh, which result in replacing the original mesh with the optimized one. To do this, select the desired objects, go to Utilities Tab → click Collapse → output type set to Modifier Stack Result → collapse selected. Note this step is nonreversible. (See Figure 17)



**FIGURE 17: MODIFIER AND COLLAPSE TOOLS**



## EXPORT YOUR MODEL FROM 3DS MAX

1. Before the model is ready to be exported, create selection sets for different objects category if your model is large (Rule of thumb: 4 million plus polygon). The main reason of breaking down the model into several category is that Unity does not handle large model very well. We recommend using Revit category as a reference for creating selection set, but no need to be as detailed as Revit category. For example, we usually create separate selection sets for: Doors, Windows, vertical partitions, horizontal partitions, furniture and caseworks, mullions, and miscellaneous, etc.
  - a. This can be done by these steps:
    - i. On the 'Scene Explorer', click 'Customize' and click 'Configure Column' (Figure 18)

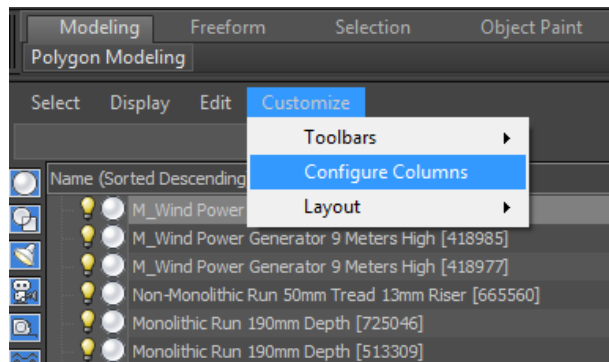


FIGURE 18: HOW TO CONFIGURE COLUMN





- ii. Find 'Revit Category' and double-click on it. This will bring the 'Revit Category' tab into the 'Scene Explorer'. Objects that are in the same category will be sorted out and organized. (See Figure 19)

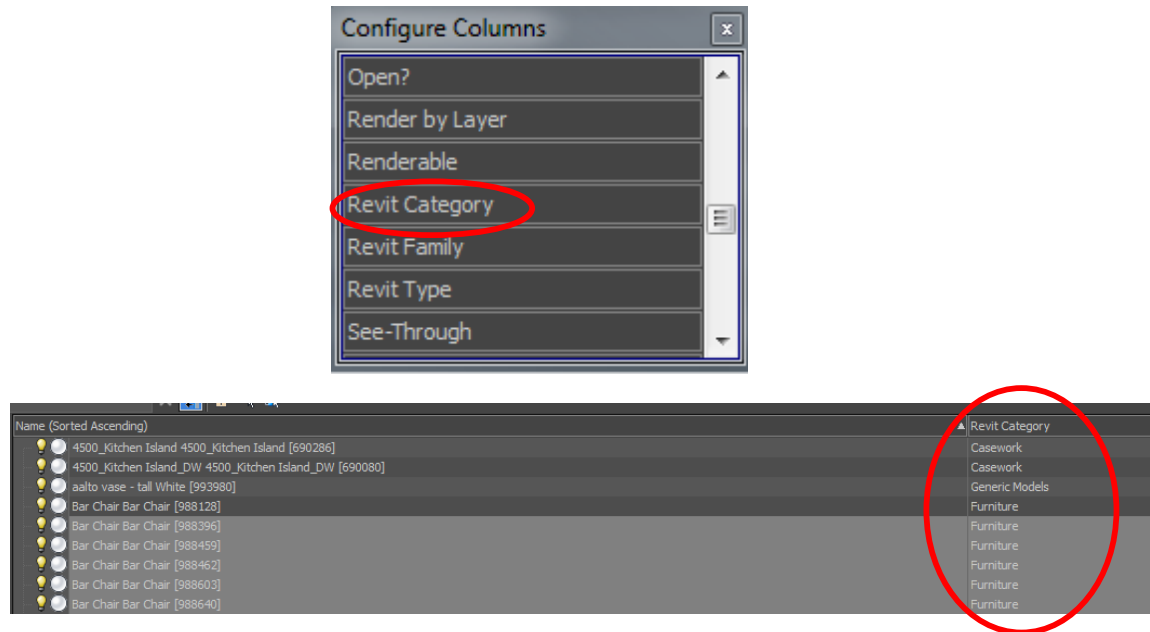


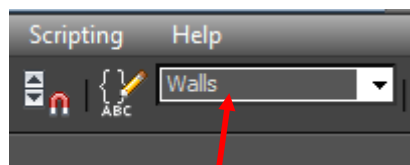
FIGURE 19: HOW TO SET UP REVIT CATEGORY



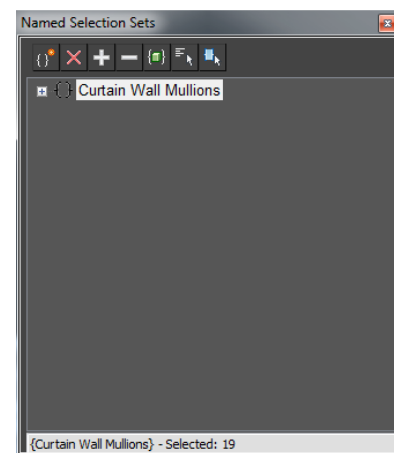
- iii. Highlight all the objects that belong to one selection set and fill in the selection set in the text box located in the toolbar before pressing enter. To

append objects to selection set, click  and 'Named Selection Sets' window will be up (See Figure 20). Add more selections sets by clicking '+' to put highlighted objects into the selection set. For full manual, please refer to:

<https://knowledge.autodesk.com/support/3ds-max/learn-explore/caas/CloudHelp/cloudhelp/2015/ENU/3DSMax/files/GUID-93B01505-5474-43D6-8B83-810BA0157A9B-htm.html>



**Input name of the sets**



**FIGURE 20: HOW TO CREATE SELECTION SETS**



2. After all the selection sets are created, click on the “M” or similar icon in the top left-hand corner of the screen. Scroll down to export and then scroll over to Export Selected as shown in Figure 21 below:

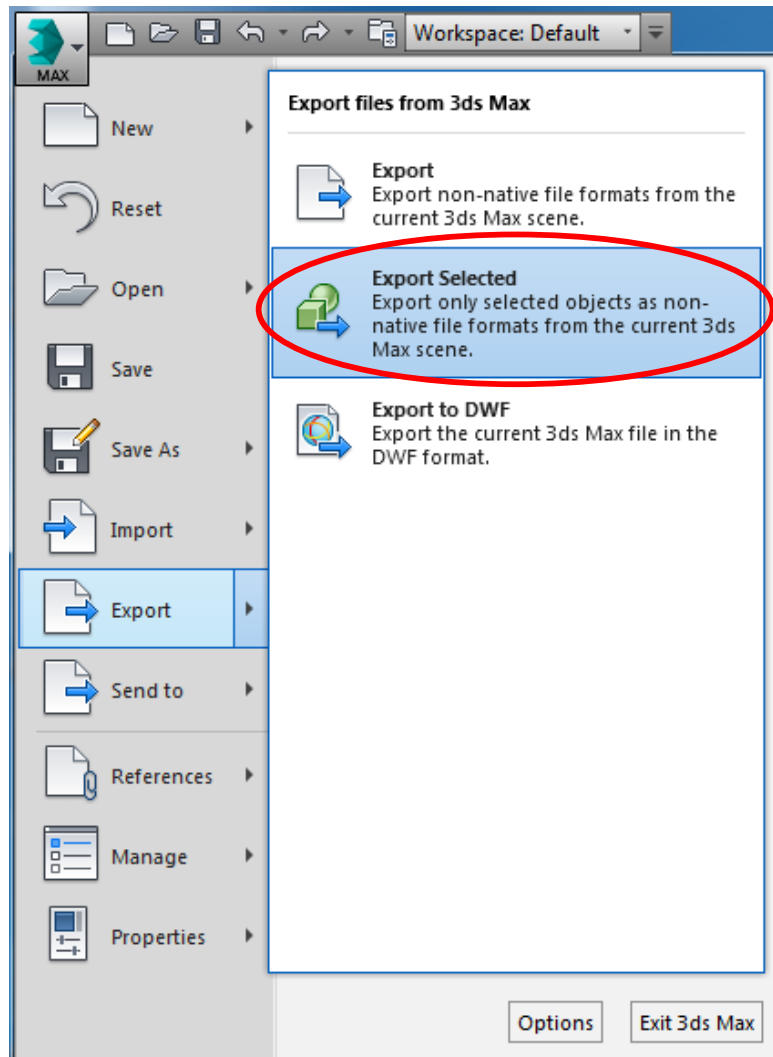


FIGURE 21: MENU NAVIGATION FOR EXPORTING A MODEL



3. Name the file, select .FBX from the File Type drop-down menu, and save the file. It is recommended that the file be exported to a dedicated folder for FBX files from 3ds max.

Change the FBX file units to centimeters in the Advanced Options and Units tabs of the FBX Export screen as seen in Figure 22.

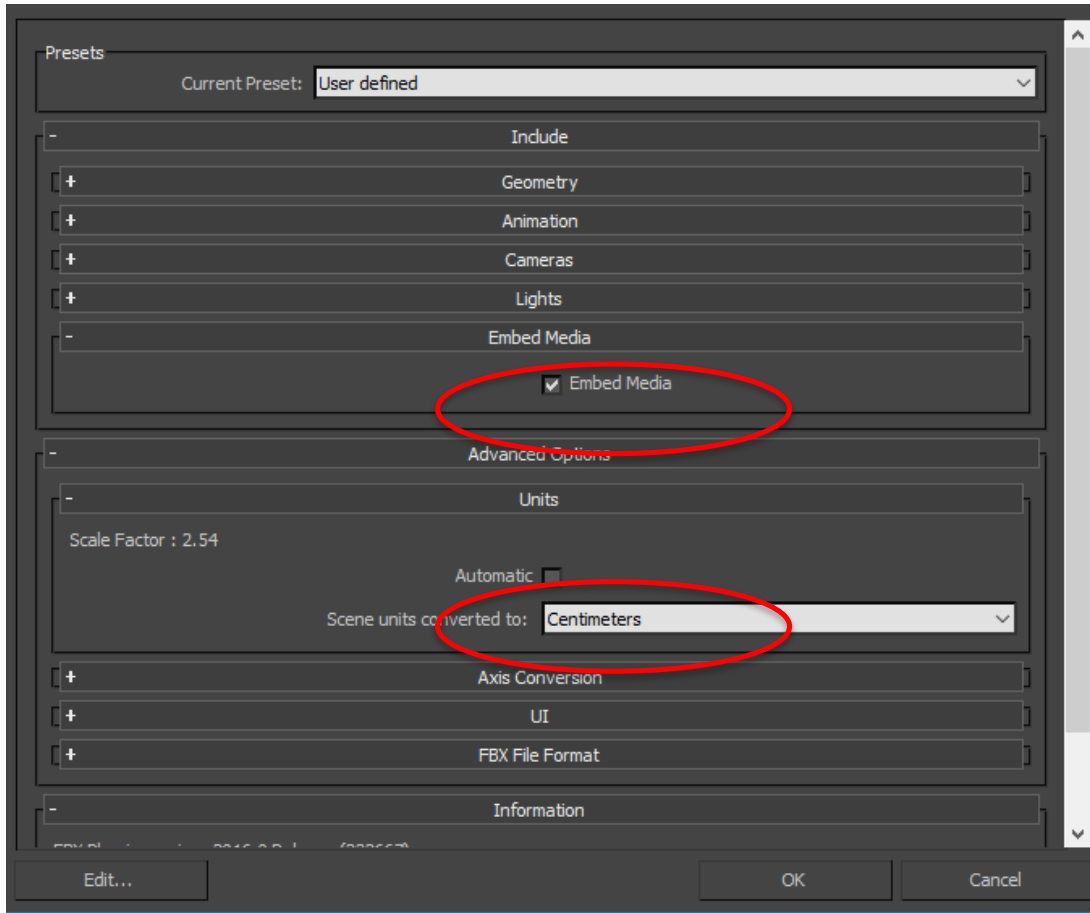


FIGURE 22: CHANGE UNITS TO CENTIMETERS

4. Check the Embed Media so that the exported FBX file contains textures.
5. Click OK and model will export the FBX file.



## IMPORT YOUR MODEL INTO UNITY

1. The Penn State CIC has developed a suite of assets in unity for better design review experience. We have set up a template project with those assets and our recommended aesthetic/rendering settings. The template project is currently available on GitHub, and will be available on the Unity asset store.

To access our template project, follow these steps:

- a. Access this webpage: <https://github.com/CICPSU/Unity-Design-Review-System> , and Download all the material by clicking, 'Download ZIP' (See Figure 23)

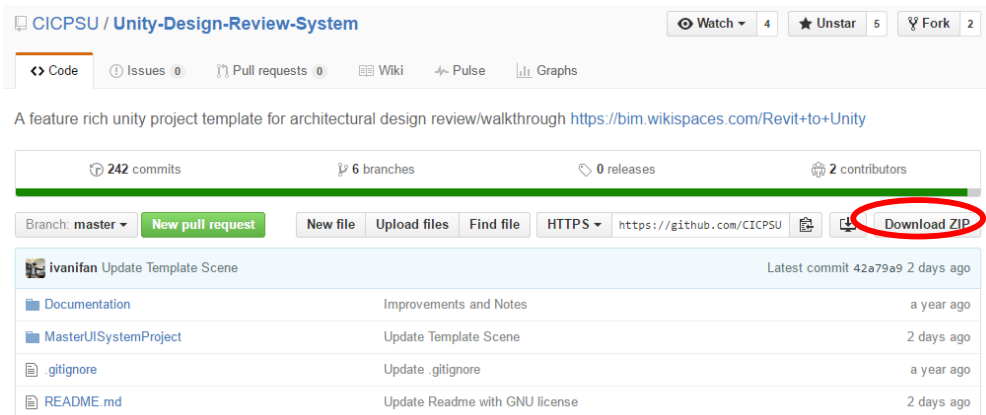


FIGURE 23: DOWNLOAD ZIP FILE FROM GITHUB.COM

- b. After the file is downloaded and extracted, [open](#) the unity project called MasterUISystemProject. Then open the scene called "Template Scene". Before uploading the 3D model into the scene, delete the 'Canvas' that has 'Developer's Note'(See Figure 24).



Delete this

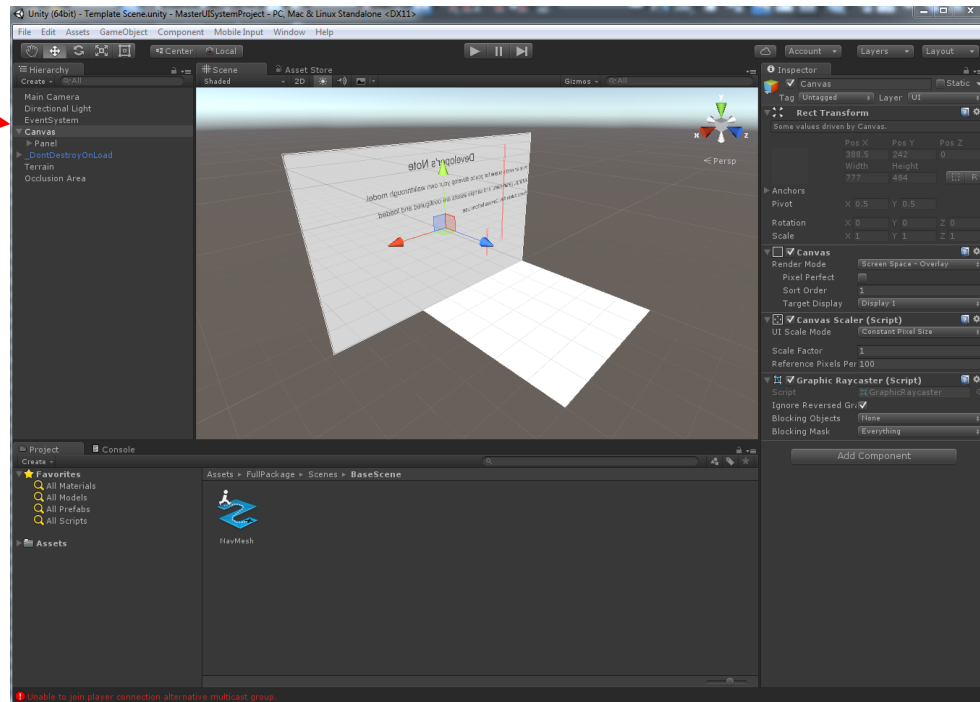


FIGURE 24: TEMPLATE SCENE IN UNITY

2. Import the FBX model exported from 3DS max by clicking 'Assets'→'Import New Asset'.  
(See Figure 25)

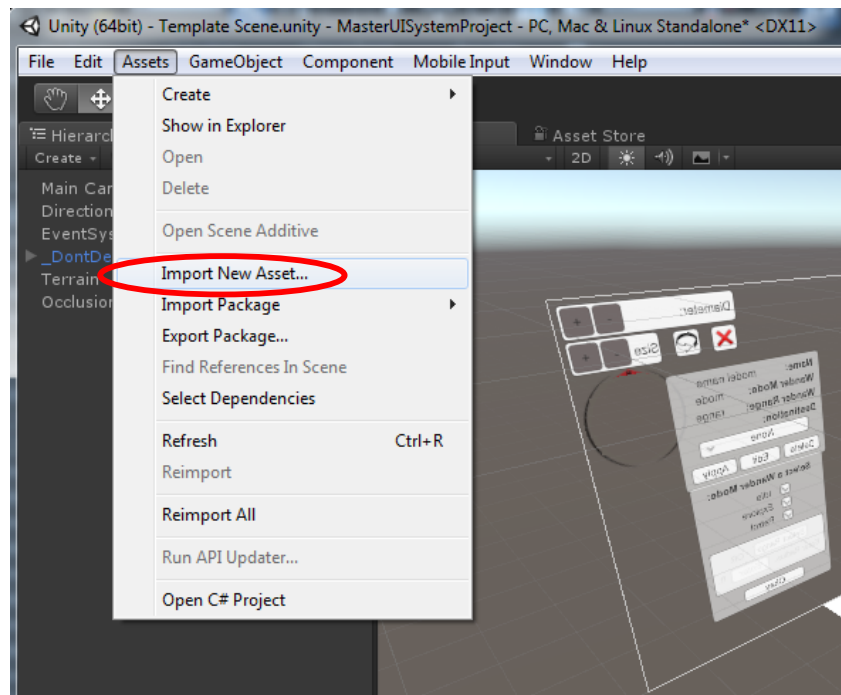


FIGURE 25: IMPORT THE INTENDED 3D MODEL BY IMPORTING NEW ASSET



Note: An alternative import method that may be faster is by transferring the intended 3D model file into Assets folder of the Unity project. This is because the Asset folder in Unity is a direct mapping from the Unity project file in the computer. (See Figure 26)

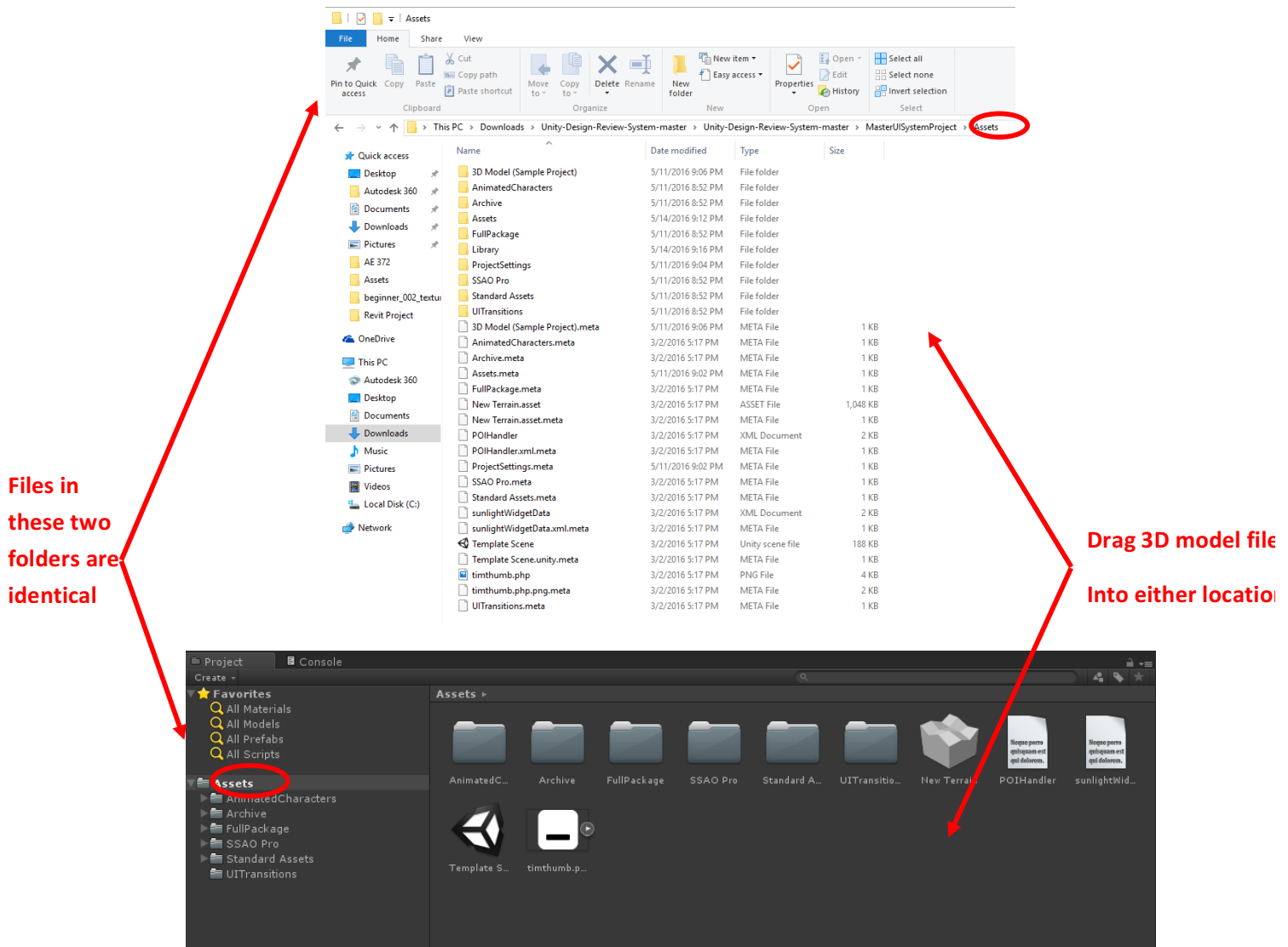
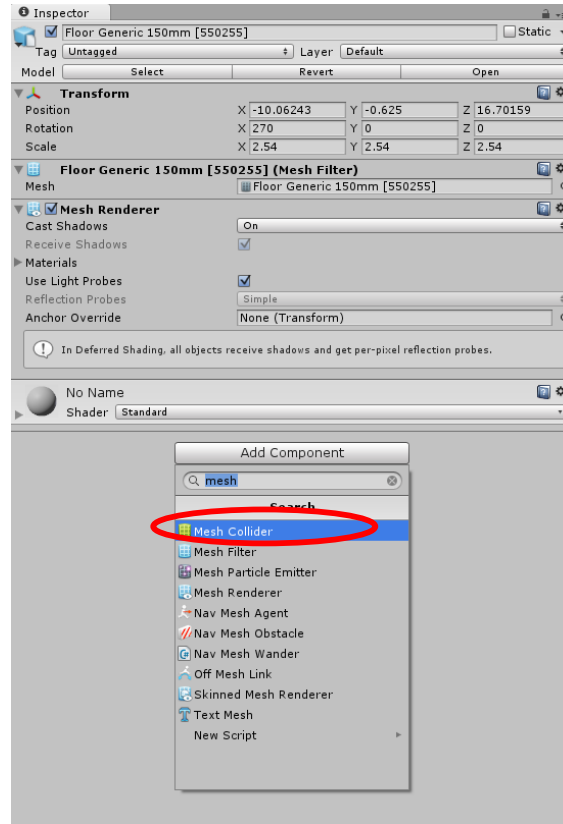


FIGURE 26: ALTERNATIVE WAY TO IMPORT MODEL INTO UNITY



3. Apply mesh collider to horizontal partitions (floor slab, terrain, etc.) to prevent avatar falling through the terrain. To include 'Mesh Collider', highlight the object that needs to be incorporated with 'Mesh Collider'→'Add Component' at Inspector→type 'Mesh Collider' and press enter. (See Figure 27)



**FIGURE 27: HOW TO INCORPORATE MESH COLLIDER INTO THE OBJECT**

Note: Putting 'Mesh Collider' into every object is not advisable as it can be costly. We recommend to not apply mesh colliders on vertical partitions and complex model elements such as walls and railings.

4. Click 'Play' to do walk through of the model.





## 5. Optional: to run model in Virtual Reality

There are two types of virtual reality displays: projection based and Head Mounted Display (HMD).

Penn State CIC maintains a project based VR display in the Immersive Construction lab ([ICon Lab](#)). These are the steps to make sure the model run smoothly in Icon Lab.

- a. Go to Edit → Project Settings → Player. (See Figure 28)

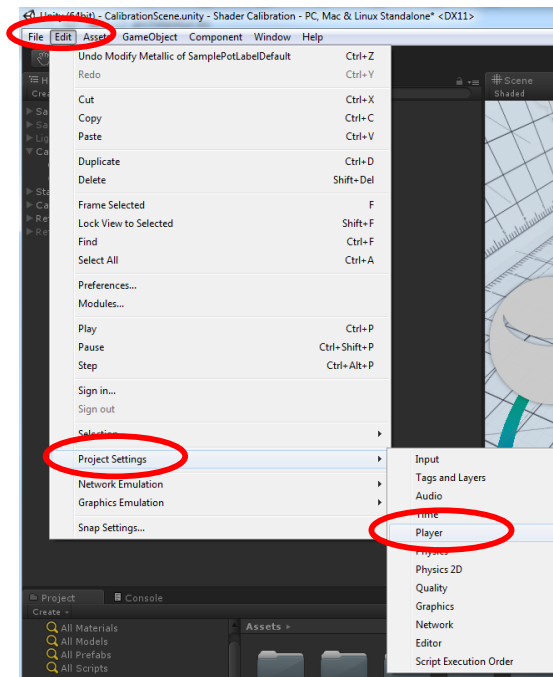
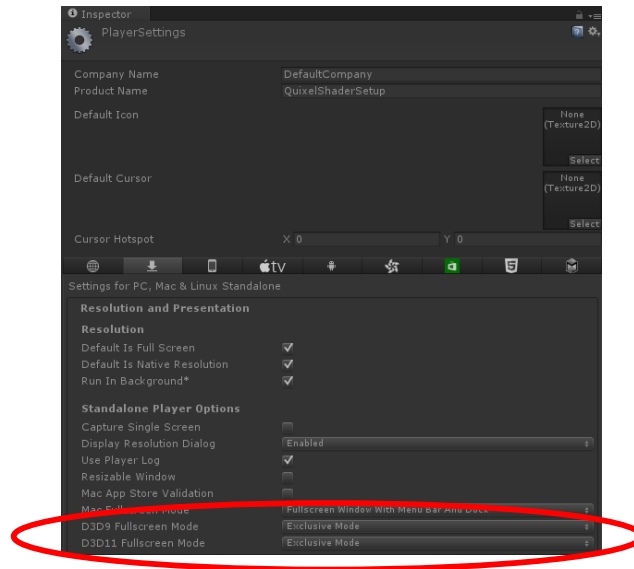


FIGURE 28: HOW TO MODIFY MODEL INTO VR COMPATIBLE

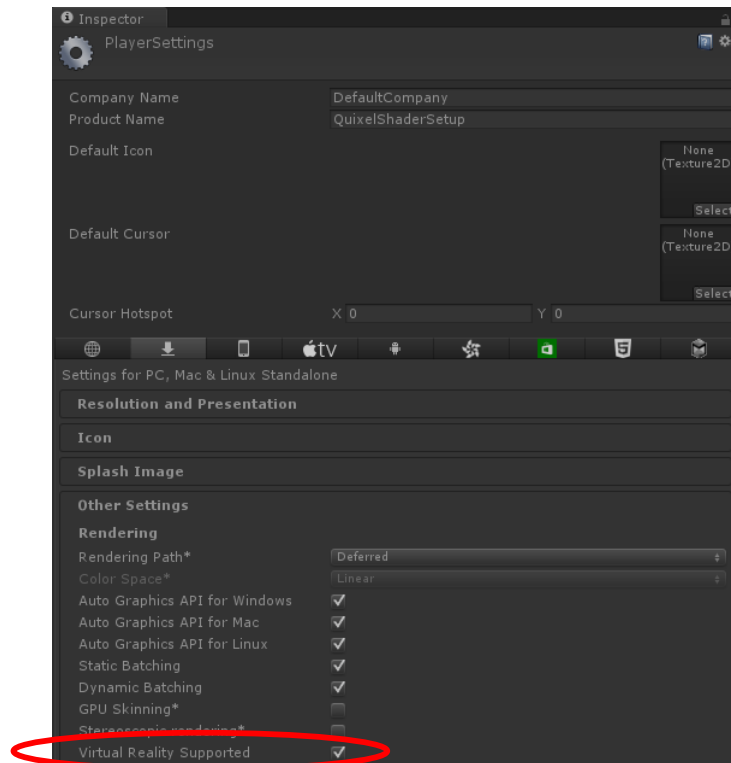


- b. At Player Settings, Click Resolution and Presentation Tab and Change D3D9 Fullscreen and D3D11 Fullscreen Mode into 'Exclusive Mode'. (See Figure 29)



**FIGURE 29: CHANGE D3D9 AND D3D11 INTO EXCLUSIVE MODE**

- c. Under 'Other Settings', checked the 'Virtual Reality Supported' box. (See Figure 30)



**FIGURE 30: CHECK 'VIRTUAL REALITY SUPPORTED' BOX**



## APPENDIX A GUIDE ON MANUAL TEXTURE MAPPING

If AMC plug-in in 3DS Max is not available, textures can still be manually applied to the objects' surface. There are several ways to apply textures to surface in Unity. To apply material in Unity manually, these are the steps:

- a. Go to slate material editor in 3DS Max by pressing 'm' on the keyboard (Step 7 on Model Optimization in 3DS Max) and pull out the Material tree.
- b. Click the material that you wished to export to Unity and locate the source. (See Figure 31)

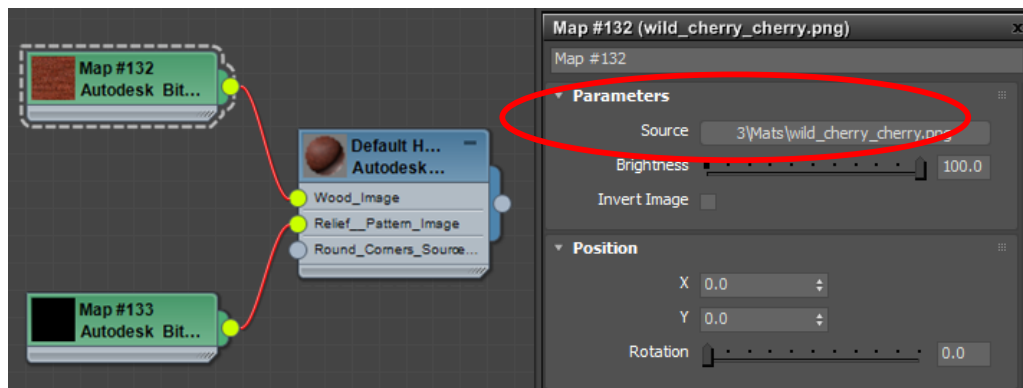


FIGURE 31: TO LOCATE THE SOURCE OF THE MATERIAL

- c. Copy the texture into Material Folder in Unity.
- d. Inside Unity, the material names should match the name of materials in the 3ds max material tree. Follow 3ds max material tree and apply textures to the corresponding materials in Unity.

